

THE COLLEGE OF STATEN ISLAND  
DEPARTMENT OF MATHEMATICS  
COURSE OUTLINE

4Cr/6Hr

MTH 330 APPLIED MATHEMATICS I

SPRING 2008

SW/M  
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TEXT: Advanced Engineering Mathematics, Sixth Edition  
by Peter O'Neil, PWS-Kent Publishing Co.

Note: Each numbered lesson corresponds to a two-hour class session.

| <u>Week</u> | <u>Lesson</u> | <u>Sections</u> | <u>Homework Problems</u><br><u>Topics</u>                     | <u>(Page/Number)</u>   |
|-------------|---------------|-----------------|---|------------------------|
| -----       |               |                 |   |                        |
| I           |               | 1.1             | Introduction to Differential Equations                        | 10/5,7,11,15           |
|             |               | 1.2             | Separable Differential Equations                              | 20/1-19(odd)           |
|             | 2             | 1.3             | Linear Differential Equations                                 | 26/1,5,7,13,16         |
|             |               | 1.4             | Exact Differential Equations                                  | 32/1,3,7,11,13,15      |
|             | 3             | 1.5             | Integrating Factors   | 37/3,5,9,14,15         |
|             |               | 1.6             | Special First Order Differential Equations (Homogeneous DE's) | 46/5,7,8,10,12         |
| -----       |               |                 |   |                        |
| II          | 4             | 1.7             | Applications - Electrical Circuits, Orthogonal Trajectories   | 55/19,23,25            |
|             |               | 1.8             | Existence and Uniqueness                                      | 60/1,5,6               |
|             | 5             | 2.1             | Introduction - Second Order Differential Equations            |                        |
|             |               | 2.2             | Theory of Solutions of Second Order DE's                      | 69/3,5,8,10,11,13      |
|             | 6             | 2.3             | Reduction of Order  | 72/3,5,7,15            |
|             |               | 2.4             | Constant Coefficient Homogeneous Linear Equations             | 77/1,3,5,9,11,13,17,21 |

MTH 330 Course Outline  
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|-------------|---------------|-----------------|--|--|
| III         | 7             | 2.5<br>2.6      | Euler's Equation<br>Method of Variation of<br>Parameters   | 81/1,3,7,9,19<br>93/1-6                    |
|             | 8             | 2.6             | Method of Undetermined<br>Coefficients   | 93/7,11,12,13,15,                          |
|             | 9             | 2.7             | Models of Mechanical<br>Systems - Simple & Damped<br>Harmonic Motion   | 105/1,4,5,11,13                            |
| IV          | 10            | 2.7<br>2.7      | Forced Motion<br>Electrical Circuits   | 110/19,21,23<br>110/25,27                  |
|             | 11            |                 | REVIEW   |  |
|             | 12            |                 | EXAM 1   |  |
| V           | 13            | 2.6             | Higher Order DE's<br>Summary of Second Order<br>Linear DE's - matrix representation<br>and geometrical interpretation. |  |
|             | 14            | 6.1             | Algebra and Geometry of<br>Vectors   | 210/1,3,7,11,13,19<br>23,25,27,28,29,32,36 |
|             | 15            | 6.2<br>6.3      | Dot Product<br>Cross Product   | 217/5,9,15,17,19<br>222/1,5,9,15,17,23,31  |
| VI          | 16            | 6.4             | Vector Space $R^n$   | 228/5,7,9,11,13,15                         |
|             | 17            | 6.5             | Linear Independence and<br>Dimension   | 235/1,5,9,17,19,25,27                      |
|             | 18            | 7.1             | Matrices   | 250/3,5,9,11,15,17,21,23,27                |

MTH 330 Course Outline  
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|-------------|---------------|-----------------|---|-------------------------------|
| <hr/>       |               |                 |   |                               |
| VII         | 19            | 7.2             | Elementary Row Operations,<br>Elementary Matrices   | 258/1,3,5,7,9,11              |
|             |               | 7.3             | The Row Echelon Form of a Matrix  | 265/3,5,7,11                  |
|             | 20            | 7.4             | The Rank and Row/Column Space<br>of a Matrix  | 271/3,5,7,9,11,17             |
|             |               | 7.5/7.6         | Homogeneous Systems of<br>Linear Equations  | 279/1,3,5,7,9,13,17           |
|             | 21            | 7.7             | Nonhomogeneous Systems of<br>Linear Equations   | 292/3,5,7,11,13,15            |
|             |               | 7.8             | Matrix Inverse  | 298/3,5,7,9,13,15,17          |
| <hr/>       |               |                 |   |                               |
| VIII        | 22            | 8.1/8.2         | Definition of the Determinant   |                               |
|             |               | 8.3             | Properties of Determinants  |                               |
|             |               | 8.4/8.5         | Evaluation of Determinants  | 313/1,3,7,9,11,13             |
|             | 23-24         |                 | Using MATLAB for manipulating matrices:<br>(I) Input; size; determinant; inverse<br>(II) Solution of systems of equations.<br>(HANDOUT) |                               |
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| IX          | 25            | 8.7             | Matrix Inverse  | 318/3,5,7,9                   |
|             |               | 8.8             | Cramer's Rule   | 320/3,5,7,9                   |
|             | 26            | 9.1             | Eigenvalues and Eigenvectors  | 320/1,3,5,7,11,13,15,17,19,20 |
|             | 27            | 9.2             | Diagonalization   | 339/1,3,5,7,9,12,13           |
| <hr/>       |               |                 |   |                               |
| X           | 28            | 9.3             | Orthogonal and Symmetric<br>Matrices  | 347/1,3,5,9,11                |
|             | 29-30         |                 | Diagonalization using MATLAB - extracting<br>Eigensolutions (HANDOUT)   |                               |

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|-------------|---------------|-----------------|--|--------------------------------------|
| <hr/>       |               |                 |  |                                      |
| XI          | 31            |                 | REVIEW   |                                      |
|             | 32            |                 | EXAM 2   |                                      |
|             | 33            | 10.1            | Theory of Systems of Linear DE's   |                                      |
|             |               |                 | 373/1,3,5,7,9,17,19,21,25,31,33  |                                      |
|             |               | 10.2            | Solution of $X'=AX$ When A is Constant   | 392/7,13,21,25,27,33,<br>35,41,43,47 |
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| XII         | 34            | 10.3            | Solution of $X'=AX+G$  | 401/15,17,19,23                      |
|             | 35-36         |                 | Using MATLAB to solve systems of<br>Linear First Order DE - ODE23/ODE45<br>(HANDOUT) |                                      |
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| XIII        | 37            | 3.1             | Laplace and Inverse<br>Laplace transforms  | 121/1,3,5,7,9,13,15,17,25,29         |
|             | 38            | 3.2             | Laplace Transform Solution<br>of Initial Value Problem                               | 126/1,3,5,8,10,13                    |
|             | 39            | 3.3             | Shifting Theorems and<br>the Heaviside Function                                      | 139/1,3,5,7,9,11,15,17,19            |
| <hr/>       |               |                 |  |                                      |
| XIV         | 40            | 3.3             | Shifting Theorems (Cont'd)   | 139/23,25,27,31,35,37                |
|             | 41            | 3.4             | Convolution Theorem  | 146/1,5,7,9,13,19,21                 |
|             |               | 3.5             | Unit Impulses and the<br>Dirac Delta Function  | 151/1,3,5                            |
|             | 42            |                 | PROBLEM REVIEW<br>REVIEW for FINAL EXAM  |                                      |